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Ontario

Biotechnology Task Force

Report

> *"The train is leaving the station, do we want to be on it or not?"*
>
> *Focus Group Participant*

Provided to: The Honourable Jim Wilson
Minister of Energy, Science and Technology

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December 24, 1998

The Honorable Jim Wilson
Minister of Energy, Science and Technology
900 Bay Street, 4th Floor
Hearst Block
Toronto, ON
M7A 2E1

Dear Minister Wilson:

In delivering this report to you, I believe the Biotechnology Task Force has met the challenge you set for us at our first meeting in October this year.

You requested the Task Force submit a report with recommendations by the end of December that could form the basis of a strategy for revitalizing and accelerating the commercialization of biotechnology in the Province.

Biotechnology is recognized throughout the industrialized world as a key sector for economic growth. Ontario is among the North American leaders in the life sciences research which is the very foundation of the bioscience industry. Ontario is also home to some of Canada's leading and long-standing bioscience companies. However, Ontario has not captured the full benefit of the commercial potential of the discoveries generated from our strong scientific base and significant research expenditures. As a result, the Province has fallen behind competing locations in the global race to commercialize this technology, recognized as a transforming new industry with enormous economic potential. Ontario is in danger of missing a narrow window of opportunity to become one of the leading centres internationally for bioscience commercialization.

The recommendations in this report are a modest, first step to address this deficiency and to harness Ontario's strengths for overall economic benefit. Taken together, the recommendations in this report constitute incremental steps in a coherent strategy to position Ontario as a leader in the global bioscience business by the year 2004. Realization of this goal would result in fourfold increases in the number of high quality jobs and revenues, with a very significant export component.
The overall target is ambitious but attainable, if the Government of Ontario, through your leadership, adopts the incremental changes embodied in the individual recommendations set out in this report and implements them in partnership with industry and academia. In doing so as a matter of urgency the Government will send a clear signal that it considers the bioscience sector a priority for Ontario.

The Task Force thanks you for the opportunity to respond to your challenge, and to produce this report on Ontario Biotechnology. We hope the recommendations will be helpful to you in improving Ontario's competitiveness in the biosciences. This will be critical in sustaining the Province's economic growth, accelerating the transformation to a knowledge-based economy and, as a result, creating skilled jobs for our youth in the next millennium.

Best regards.

Graham Strachan
Chair of the Ontario Biotechnology Task Force

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Executive Summary

Biotechnology is at the same point today that information technology was 20 - 30 years ago—the full extent of the profound changes it will bring about are difficult to imagine. With the rapid pace of underlying scientific developments, now is the time for Ontario to capture the momentum inherent in biotechnology. To take full advantage of this new technology and the promise it holds, Ontario needs a co-ordinated strategy to maximize our current investment in scientific research, attract new investments and capture our share of the highly skilled, knowledge-based jobs that will be created.

Over the last four or five years, Ontario's leadership position in biotechnology has slipped from its once dominant position in Canada to second when compared to other provinces. Between 1994 and 1997, Ontario dropped from being the location of 40 per cent of biotechnology companies in Canada to 27 per cent. Overall, Ontario is currently ranked 11th in North America for biotechnology investment. Our goal now is to arrest the slippage and reestablish Ontario's leadership to become the 6th ranked jurisdiction in North America within five years.

The vision of the Ontario Biotechnology Task Force is to ensure that Ontario is the preferred site in North America for new investments in human, financial and intellectual capital in biotechnology. These new investments will position Ontario as the home to excellence in health, agriculture and food, and bioinformatics providing highly nutritional foods, innovative medical products such as diagnostic kits, new medicines, and procedures such as gene therapy—life enhancing technologies that will increase the well being of our society. Our vision for a strong and co-ordinated biotechnology industry in Ontario could result in major economic benefits in the next five years:

- hundreds of innovative products from new discoveries;
- 6,500 more high quality, well-paid new jobs in the province;
- potential payroll increase of $400 million;
- $40 million increased investment in new construction;
- $23 million in added annual rental income;
- Ontario's brightest scientists and managers retained in Ontario;
- Ontario will be a premier Biotechnology Commercialization Centre.

This growth will be based around three networks which currently form the focus for Ontario's biotechnology industry:

- health sciences
- bioinformatics
- agriculture and food

Overall, the biotechnology industry could be worth $1 billion in Ontario by the year 2004. To ensure Ontario seizes this opportunity presented, the Task Force recommends that the province adopt a comprehensive strategic plan. This plan invests in and builds on the province's strengths: its people, a culture of innovation, and infrastructure. These are the same elements identified by the Premier's Ontario Jobs and Investment Board as the foundation for developing a strong, vibrant industry.

The government has taken initial steps in creating a foundation from which the biotechnology industry can flourish by establishing the $500 million Ontario Research and Development Challenge Fund, the new Premier's Research Excellence Awards and reducing red tape and taxes.

We recommend that the Ontario government, under the leadership of the Minister of Energy, Science and Technology jointly with leaders from Ontario's industry and academia take Ontario into the 21st Century as one of North America's preeminent centres for biotechnology.

We recommend for this strategy that a single program initiative in partnership with the private sector, research institutions and other governments be developed to work toward realization of this vision.

This report outlines specific initiatives that form our recommendation for a coordinated biotechnology strategy.

The Recommendations

People

We recommend that:

- The political champion for biotechnology be the Minister of Energy, Science and Technology who will work with leaders from Ontario's industry and academic community.
- An arms length advisory council, comprised of leaders from industry and academia, be established.
- A provincial interministerial council be established to coordinate biotechnology activity across the Government of Ontario and an Ontario Biotechnology Secretariat be formed to provide a single window access to the Ontario government.
- In partnership with government, industry, and academia, biotechnology networks from each of the three areas of excellence be cultivated to work cooperatively to strengthen the industry and create public awareness.
- In partnership with industry and research institutes, the Ontario government build on existing programs that nurture talented students of biotechnology in high schools.
- The government, in partnership with industry, establish a cooperative program to promote interaction between under-graduate and graduate students and industry.
- The provincial government partner with the federal Biotechnology Human Resources Council in key areas of professional and management training.

Culture of Innovation

We recommend that:

- Entrepreneurial Awards be established for faculty and research scientists in public institutions of Ontario to foster entrepreneurship.
- Government, in partnership with industry and academia, build on existing mentoring programs that the business service sector, universities and research institutes have created in Ontario.
- The government, in partnership with industry and academia, stage a world class biotechnology conference whose major purpose would be to profile Ontario's success stories, and attract top-level foreign investors and participating companies from the U.S. and Europe.
- The Minister of Energy, Science and Technology attend major events showcasing the industry provincially, nationally and internationally.
- The leaders from the three biotech communities, in partnership with government, undertake a major responsibility for fostering awareness and relationships with the public.

Infrastructure

We recommend that:

- The Ministry of Energy, Science and Technology in partnership with industry, academia and community stakeholders create small scale commercialization centres.
- The Government of Ontario in partnership with the private sector provide bridge financing to biotechnology growth companies in the form of delayed-repayment loans.
- The Ontario Innovation Tax Credit and the Ontario Super Allowance be made refundable for private and publicly traded companies.
- The Province of Ontario encourage the federal government to implement similar fiscal policies for Research and Development Tax Credits for public biotechnology companies.
- Biotechnology products approved for sale in Canada receive timely access to the Ontario market. In return, the industry should be required to reinvest a percentage of its net sales revenue towards the further development of biotechnology in Ontario.
- The Ontario Biotechnology Secretariat advocate for a timely regulatory approvals process for biotechnology products.
- Government, in partnership with academia, support the efforts of universities and research hospitals to protect their intellectual property.
- 50% of patent protection costs be eligible for refundable tax credits for start up biotechnology companies.

The Vision

> *"To be internationally recognized as the preferred location for NEW investments in human, financial, and intellectual capital in biotechnology."*
>
> Ontario Biotechnology Task Force, 1998

We are at the beginning of a scientific revolution in biology and medicine that will be as important and transformative as the revolution in the 20th Century in physics and chemistry. That earlier revolution led directly to the telephone, radio and television, the computer, advanced materials, the airplane and the automobile. The revolution in biology will transform our approach to human health and agriculture and will be built upon the convergence of the two dominant and still rapidly evolving technologies - biotechnology and information technology.

Biotechnology will have a profound impact on improved **health** through our ability to predict, diagnose, prevent, and treat disease. It will improve **agriculture, food and forestry** through our ability to improve plant and animal productivity, prevent diseases, reduce pesticide usage, enhance nutritional quality and shelf life of food. It will generate plants and animals for industrial and medical processes. It will improve the **environment** through bioremediation of contaminated sites and fossil fuel reduction. It will improve **industrial** production by substituting biological processes for current chemical processes. **Bioinformatics** will also play a vitally important role. It harnesses the power of information technology to analyze biological data and enhance our understanding of molecular processes. A world demand for information management of genetic knowledge will provide a huge opportunity for our already world class information technology companies. Biotechnology will profoundly alter the well-being of Ontarians, Canadians and mankind generally.

Just as with the automobile, aerospace and computer industries, hundreds of companies and thousands of new well-paid high quality jobs will develop that provide innovative niche products to the biotechnology industry, similar to Magna for the auto industry, and Corel and Newbridge for the information technology sector. Likewise, biotechnology will create significant new knowledge-based jobs in Ontario.

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"The 21st Century has been aptly called the Biotech Century. Over the next 25 years, we will witness an explosion of new knowledge about human health and disease based on our growing understanding of the function of the 100,000 genes in the human genome. These new insights are already forming the foundation for new ways of diagnosing, preventing and treating disease. Ontario is ideally positioned to be a world leader in this biotech revolution, creating both new medicines to cure disease and exciting research jobs for young Canadians."

Alan Bernstein
Samuel Lunenfeld Research Institute

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The Urgency

The task force focused on ***advanced biotechnologies***, generally considered as the ability to identify, determine the functionality, and potentially modify genetic information using techniques of molecular biology and information science. The commercialization of this science will lead to innovative medical products such as diagnostic kits, new medicines, highly nutritional foods, and novel procedures such as gene therapy- life enhancing technologies that will increase the well being of our society.

Based on the past five years, we believe that with a biotechnology strategy in place, the following will be Ontario's increased opportunity within the next five years:

- Ontario will have the opportunity to commercialize hundreds of innovative products resulting from the sequencing and patenting of the human genome and that of major crops;
- Ontario will be net *exporters of* biotechnology products rather than net importers of this technology
- 6,500 new high technology, value added jobs will be generated that will spin off even more jobs in allied industries;
- potential payroll revenues of $400 million will be gained;
- $100 million in construction investments will be generated as companies build new or expand existing facilities, and commercialization centres are established around the province;
- $23 million in annual rental income will be gained by new biotechnology start-up companies seeking commercial space and a growing service industry responding to their needs;
- Ontario's brightest scientists, managers and technologists will stay here to make new discoveries and create companies in Ontario; other highly skilled people will want to relocate to Ontario to participate in these activities;
- Ontario will be a leading biotechnology commercialization centre in North America and the preferred site for new investment.

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"Now is the time for Ontario to capture the momentum inherent in biotechnology as a transforming new technology and as an economic driver for the next millennium. Taken together, the recommendations in this report constitute incremental steps in a coherent strategy to position Ontario as a leader in the global bioscience industry by the year 2004. In implementing the recommendations, in partnership with industry and academia, the Government will send a clear signal that it considers the bioscience sector a priority for Ontario."

Graham Strachan,
Allelix Biopharmaceuticals Inc.

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Biotechnology is "the application of science and engineering in the direct or indirect use of living organisms in their natural or modified state".

Canadian Environment Protection Act

◆

The Goal

Over the last four or five years, Ontario's leadership position in biotechnology has slipped from its once dominant position in Canada to a poor second when compared to other provinces. Between 1994 and 1997, Ontario dropped from being the location of 40 per cent of biotechnology companies in Canada to 27 per cent. This slippage is due in part to the changing market environment for start-up companies and the increased focus of other governments to strengthen their respective biotechnology industries. Overall, Ontario is currently in 11th position in North America. Our goal now is to stop the slippage and reestablish growth within Ontario's biotechnology community (*See Appendix 1*).

We are confident that with the support of a biotechnology strategy, Ontario will be repositioned as one of North America's preeminent centres for biotechnology.

Within the next five years, Ontario will move up into the:

- top three in rate of revenue growth in agri-food biotechnology;
- top six in rate of growth in human and financial investments in health care and bioinformatics;
- top six in rate of commercialization - new companies and royalty/licence revenues;
- top six in revenues generated by biotechnology;
- top six in rate of growth in biotechnology jobs;
- top ten in research publications, and patents in the areas of focus;

To meet this challenge, the strategy focuses on the three pillars of people, a culture of innovation and infrastructure which have been identified by the Ontario Jobs and Investment Board as the foundation for developing a strong, vibrant industry. In advising the Premier on an economic vision for the province, the Ontario Jobs and Investment Board regards each pillar as a critical element in creating value-added innovation, jobs and investment in Ontario.

> "The boomers are coming, is our food system ready?"
>
> Murray McLaughlin
> President, Ontario Agri-Food

People: The Need

Leadership

A "Political Champion" for the industry at the highest level of government is essential to galvanize the future vitality of biotechnology in Ontario. This responsibility, however, does not rest alone with government. Leadership must emerge from industry as well. All sectors of the biotechnology community need to have an active role in creating a dynamic biotechnology industry. The government through forward thinking policies has taken a positive step in establishing the $500 million Ontario Research and Development Challenge Fund which has already generated exciting biotechnology research projects. The opportunity is now, through effective partnerships amongst government, industry and academia, to capture the full potential of the biotechnology industry in Ontario.

Other jurisdictions in North America have demonstrated the benefits of strong industry/government partnerships. In the United States, the Biotechnology Industry Association under the leadership of companies like Amgen, Genzyme and Genentech has taken an active role in working with political leaders such as Vice President, Al Gore to further develop its already successful biotechnology industry. Effective cooperation between the Government of Saskatchewan and Ag-West Biotech Inc. established through the leadership of Murray McLaughlin, has developed one of the world's leading agriculture biotechnology centres. Quebec has captured the leadership position in Canada for biotechnology and is generating success stories like Biochem Pharma through leadership demonstrated by Industry Minister, Bernard Landry and long-standing partnerships with Quebec's financial community.

In Ontario, we recognize that nine provincial ministries have a significant role in, and impact on the biotechnology industry. Through the coordination of the Ministry of Energy, Science and Technology, each minister must be a catalyst for his or her sector and be supported by industry and academia through strong partnerships.

We recommend that the political champion for biotechnology be the Minister of Energy, Science and Technology. The Minister will work with leaders from Ontario's biotechnology industry and academic community. He will work with cabinet colleagues and the Ontario Jobs and Investment Board. He will engage the Premier in special biotechnology events and advocate the opportunities this technology offers for creating jobs and improving the quality of life for Ontarians.

We recommend that an arms length advisory council, comprised of leaders from industry and academia, be established. This council will advise the Minister of Energy, Science and Technology on areas of priority for the biotechnology industry and will serve as a mechanism to develop strong government/industry/academia partnerships.

We recommend that a provincial interministerial council be established at a senior level to ensure coordination of biotechnology activity across the Government of Ontario.

We recommend that an Ontario Biotechnology Secretariat be formed to provide a single window access to the Ontario government and to partner with industry and academia to develop this multimillion dollar industry.

People: The Need

Community Networks

We recognized three cohesive biotechnology networks. These networks have the critical mass of academic and research excellence, focused areas of research expertise, community organization, community vision and ready access to national and international transportation that Ontario offers.

Over 40% of Canadian research and development in biotechnology takes place in Ontario. Toronto's medical research community is one of the top three centres in North America with the University of Toronto providing the largest medical faculty on the continent. Ontario's excellence in medical research has proven itself with over 25% of disease related genes discovered through the participation of Ontario's researchers.

In agriculture biotechnology research, Ontario's diversified agriculture production has led to leading edge research in functional foods and crop production. Guelph offers state of the art laboratory facilities including the molecular supercentre and has attracted prominent international investors such as Novartis Crop Protection to its research park.

The well developed cluster of world class information technology firms in the Ottawa area provide an excellent base for the development of bioinformatics. Many of these companies are looking to invest in the life sciences as part of their diversification strategies.

We need to foster Ontario's biotechnology communities to continue building existing research strengths and to create greater partnerships between them. We encourage them to reach out to other clusters and have them actively work with their local communities and other centres in promoting public awareness of biotechnology, its opportunities and risks. Other communities located across the province are poised to develop into focused centres, and this should be supported vigorously.

The current areas of excellence are:

- health sciences
- bioinformatics
- agriculture and food

Networks need to be established to create coordination within and amongst these areas of excellence. These networks will promote synergies and leverage our resources and research opportunities. We believe that the interfaces between food, health, informatics and genomics may provide Ontario's greatest competitive advantage. A unified voice for the Ontario biotechnology community is required to capture such potential.

We recommend that in partnership with government and industry, communities from each of these three areas of excellence be cultivated to cooperatively:

- foster commercialization and the building of new companies in partnership with appropriate stakeholders;
- showcase Ontario's excellence by developing an annual world class conference;
- develop local, provincial and international commercial and scientific awareness campaigns;
- act as ambassadors for Ontario at international events;
- provide guidance in creating commercial activity.

Research teams are forming across the province to begin the development of such interfaces. For example, the London Health Sciences Centre endowed with a xenotransplant chair, partnered with the University of Guelph and the University of Toronto and its affiliate hospitals to pursue joint research in xenotransplantation. This leading edge research is expected to bring a solution to current organ donor shortages.

People: The Need

Future Skills

The key resource for advanced biotechnologies is bright-young innovative minds entering this field of science. It also includes personnel with computing skills, management skills, communication skills, and others. Approximately 70% of start-up biotechnology companies are created from science developed at universities.

The Task Force recognizes the recent efforts made by the Government of Ontario to help meet the future demands of human skills necessary to develop a strong biotechnology industry. Programs such as the Premier's Research Excellence Awards and Access to Opportunities are a good first measure in ensuring that our valuable human resources are developed and in retaining and attracting talent.

However, Ontario currently has the lowest Canadian per capita investment in students at our universities and community colleges. The Task Force urges the Government of Ontario to carefully review its funding strategy for science teaching and research in academic institutions, and to put in place initiatives to raise the level of public funding for universities and community colleges.

In Ontario, cooperative programs are limited in number and scope. Employers have indicated a need for graduates with industrial experience developed through such programs. A lack of cooperative programs has encouraged the flow of talented entrepreneurs outside the province, where cross fertilization programs already exist.

Identifying and nurturing our best students will be a key factor in Ontario's future success in biotechnology. Students need the opportunity to work with industry to hone their talents for the future. They need a range of skills gained beyond the laboratory and classroom. They need multi-disciplinary training and exposure to industrial problems as part of the education process. Employers involved in cooperative programs want far longer work terms. This would prove to be beneficial to both employers and students.

We recommend that the Ontario government in partnership with industry and research institutes build on existing programs, that nurture talented students of biotechnology in high schools.

We recommend that the government in partnership with industry establish a cooperative initiative at the under-graduate and graduate levels to promote student interaction with industry. This initiative could take the form of work placements with companies, hospitals and private research institutions.

We recommend that the provincial government partner with the federal Biotechnology Human Resources Council in key areas of professional and management training.

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> "Our company's continued success depends on access to highly-trained scientists and technicians. Partnerships between government, industry and academia are necessary to build these skills. The Connaught Student Biotechnology Exhibition is a great example of how successful partnerships can be. Introducing students to careers in biotechnology benefits us all."
>
> J. Mark Lievonen
> Pasteur Mérieux Connaught Canada

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Culture of Innovation: The Need

Culture of Entrepreneurship

A culture of entrepreneurship centres on individuals willing to take risks and initiatives to foster ideas and products they believe in. That risk often involves personal sacrifice both in time and money.

This entrepreneurial spirit cannot be dictated from government or senior administration of research institutions. It must be nurtured and rewarded. By its very nature, entrepreneurship can lead to failure but the rewards can be large not only for the individual, but for the communities as jobs are created and products sold in international markets.

In Ontario, the majority of biotechnology companies are small with less than 30 employees. They are often started as spin-out companies from public institutions where faculty and researchers decide to become entrepreneurs. With the exception of a few individuals who were willing to take the risk and consequently developed successful start-up companies, these entrepreneurial researchers remain very much a minority in our public institutions. Most researchers have little industrial experience, and lack the resources and training to become entrepreneurs. We need to nurture those individuals wishing to seek knowledge from, and provide knowledge to, Ontario biotechnology companies, and encourage those who have discoveries they wish to see commercialized.

We recommend that an Entrepreneurial Awards Initiative for faculty and research scientists in public institutions of Ontario be established to foster entrepreneurship. This would apply:

- to faculty seeking sabbatical opportunities with an Ontario-based biotechnology company to enhance their understanding of the commercial environment;
- to faculty and researchers interested in developing a company, developing business plans and seeking venture capital to commercialize their discovery.

We recommend that government in partnership with industry and universities build on existing mentoring programs that the business service sector, universities and research institutes created across Ontario. Such mentoring programs focus on start-up companies and provide advice on seeking seed capital developing convincing business plans, securing patent protection and technology assessments.

Some of Ontario's leading researchers pioneered a culture of entrepreneurship by creating companies in Ontario based on their discoveries.

- Dr. George Jackowski, Professor at the University of Toronto's Department of Laboratory Medicine and Pathobiology is an MRC Scholar and a former scientist at the Hospital for Sick Children, who has an established track record for building successful biotechnology companies. After co-founding the successful company, Spectral Diagnostics Inc., Dr. Jackowski recently created Skye PharmaTech Inc. which is already on a revenue curve and has 17 high value employees who are developing an early diagnostic test kit for strokes using biochemical markers. Dr. Jackowski is well on his way to achieving another success.
- Dr. Jonathon Schmidt, Professor at the University of Guelph's Environmental Biology Department is also Director of Technology Development at Nanodesign Inc., a company formed by GUARD based on Dr. Schmidt's technology. The company develops computer-based molecular models which will lead to significant cost reductions in the development of new pharmaceutical products.

- Dr. Chandra Panchal, President and CEO of Procyon Biopharmaceutical Inc. and Adjunct Professor at the University of Western Ontario, having authored over 50 scientific papers, co-founded this well known London-based company. Procyon is one of Ontario's leading biotechnology companies. Dr. Panchal is also Director of three biotechnology start-up companies and has been named Entrepreneur of the Year by London's High Technology Association.

- Dr. Tofy Mussivant, Director of the Cardiovascular Devices Division of the University of Ottawa Heart Institute established World Heart Corporation with a team of clinicians, researchers and entrepreneurs. A successful publicly traded company with now 80 employees, internationally renowned World Heart developed the world's most advanced technology for pulsatile ventricular assist devices which will allow people with heart failures to return to a near normal life.

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"Our entire operation moved from Winnipeg to Toronto in September, 1998 to take advantage of the unique financial opportunities that exist in the Toronto area. A new biotechnology company requires strong financial backing to succeed, and our move to Toronto puts our company in the heart of Canada's financial activities... GeneSense is a drug discovery company with a focus on developing anticancer reagents. Toronto has a very strong medical research structure in its universities, hospitals and research foundations, and we believe that GeneSense will benefit from associations with the Toronto research community.

Jim A. Wright
GeneSense Technologies Inc.

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Culture of Innovation: The Need

Culture of Success — Showcase Ontario

Success breeds success! Creating a culture of innovation starts with celebrating risk-taking and vision. Unfortunately, Ontarians do not celebrate their achievements. The world remains largely unaware of biotechnology. As a result, the industry has not attracted the cadre of young entrepreneurs needed to sustain its growth. Nor has the industry secured the public acceptance and support vital to its future.

Beyond our borders, Ontario is increasingly overlooked. Well-funded marketing campaigns in other regions attract much needed investment, labour talent and corporate partnering away from Ontario. BioContact Quebec is Canada's premier annual biopharmaceutical conference now in its 6th year. This partnering event successfully brings together investors and biotechnology companies from across Canada and garners an increasing level of international participation.

The province needs to put in place immediately, and at the highest level, a consistent strategy for showcasing our innovative science and technology, our exciting new companies, and our entrepreneurial flair. "Showcase Ontario" will be the major responsibility of the focus centre leaders, and will be run on a professional basis with the best talent available. Building momentum and profile takes time: it will require dedicated funding, not the sporadic support typical of today.

We recommend that:

- the government in partnership with industry and academia stage a world class biotechnology conference whose major purpose would be to profile Ontario's success stories, and attract top-level foreign investors and participating companies from the U.S. and Europe;
- the Minister of Energy, Science and Technology attend all major events showcasing the industry provincially, nationally and internationally.

> We welcome the government's recent partnership in supporting an industry/academic initiative which will showcase Ontario's health research and emerging biotechnology companies. Designed as a regional event, this initiative has the potential of becoming a world class international conference.

Culture of Innovation: The Need

Public Awareness

Most Ontarians are unaware of the industry's vitality and importance to the province's future economic growth. Others remain skeptical of the industry's ability to deliver on its promises. Still others share concerns about the ethics of genetic screening, cloning, novel foods and their safety.

The citizens of Ontario need to be engaged in understanding the opportunities and risks this technology offers. Informed public support will help ensure Ontarians are early adopters of new technologies, particularly as the business matures and more products reach the marketplace. In the agri-food arena, public acceptance will prove essential. The biotechnology community must partner with interest groups to foster an appreciation of the opportunities and how risk is managed in a quick, open and responsive manner.

Public confidence is dependent on open, and transparent communications. This begins at the local level and builds to a national consensus. Companies and research institutes must play an active role in conveying the excitement of biotechnology objectively and convincingly, through hosting open houses, participating in mentorship programs, high school visitations, and active media outreach.

We recommend that the community leaders in partnership with government, undertake a major responsibility for fostering relationships with the public through:

- working cooperatively to showcase Ontario's accomplishments through provincial, and national media outlets and through websites, focusing on organizations such as the Food Biotechnology Communication Network to respond to consumer concerns;
- regularly addressing consumer groups, service clubs, local media and local educators to educate and inform;
- supporting a series of regional meetings, workshops, and seminars highlighting exciting advances, and discussing ethical and safety concerns;
- working with the federal Biotechnology Secretariat to coordinate public outreach, and devise a means for creating constructive dialogue.

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"Biotechnology in its advanced form of genetic engineering is fairly new and most consumers are unaware of the potential risks and future benefits this science offers. Consumers need reliable information, an open and transparent regulatory system and an opportunity to participate in the national debate on biotechnology through community based consultations."

Ruth Jackson,
Consumer's Association of Canada

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Infrastructure: The Need

Commercialization Centres

Commercialization centres across North America have powerfully accelerated job creation and investment growth. Other governments have heavily invested in commercialization centres as an engine for economic development. Saskatchewan invested in the highly renowned Innovation Place. Quebec invested in numerous commercialization centres around the province and is home to the federally funded flagship Biotechnology Research Institute which employs 550 scientists. British Columbia is reaping the rewards of over 71 company spin-offs from the University of British Columbia affiliated incubators. Ontario has fallen behind other Canadian jurisdictions in developing start-up biotechnology companies, and a major factor is the lack of effective commercialization centres.

A typical commercialization centre offers specialized laboratory space and access to capital intensive equipment, office facilities and management expertise to start-up companies. Core tenants of commercialization centres are companies that emerge from universities and research institutes, and remain in the centre for approximately 2 - 5 years.

Commercialization centres reduce requirements for initial funding, and can shorten the time to market and profitability. Incubator companies have a much better chance of success: 80% of companies graduating from such commercialization centres succeed compared to 20% of companies that were not developed through such centres.

We recommend that the Ministry of Energy, Science and Technology in partnership with industry, academia and community stakeholders create small scale commercialization centres.

These centres would be located in close proximity to existing research institutes and universities such as the proposed pilot site in Toronto. Community initiatives and investment must support a solid business case for long term self funding.

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"Incubators shelter.....scientists whose ideas might make a fortune but are too fragile at this point to survive in the free market."

Michael Lewis,
The New York Times Magazine

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"Technology incubation can foster corporate and community collaborative efforts, while nurturing positive government-academic-business relationships. These new types of organizational alliances incorporate a dynamic private sector; a creative role for government through technology policies, initiatives and development programs; and innovative academic relationships."

George Kozmetsky
IC2 Institute, The University of Texas

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Infrastructure: The Need

Strategic Investments

Over the last 5 years, there has been a major expansion of venture capital in Canada (and Ontario) investing in innovative biotechnology companies. Ontario is the heart of Canada's financial community and home to growing venture capital funds which is an important factor for companies deciding to relocate to the province. While there is ample seed funding available for companies that offer good science and a convincing business plan, there is still a funding need for early stage biotechnology companies pursuing the commercialization of products in Ontario. Companies at a later stage of development, approaching commercialization, continue to have problems in raising necessary capital. This has been accentuated over the last 18 months as the interest of the public equity markets in biotechnology has waned.

The very nature of financial markets remains dynamic; venture capital will keep adjusting and public equity markets will continue to fluctuate. Given the long cycle for developing biotechnologies from the laboratory bench to the marketplace (7-15 years), the cash burn rate of this industry is unique. A strategic fund, structured as bridge financing, would help create a more stable financial environment for biotechnology companies. This is particularly critical for biotechnology companies, as they seek private sector funds to advance their research into commercial products. Other jurisdictions have benefitted from the economic returns these investments offer. An example being Saskatchewan's Ag-West Biotech capital investments which generated an incremental $37 million of research activity and yielded a 4.7-1 leveraging ratio.

We recommend that the Government of Ontario in partnership with the private sector provide bridge financing to biotechnology growth companies. This would help bridge the financial requirements of growth phases experienced by biotechnology companies. Bridge financing would be in the form of delayed-repayment loans.

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"There is a direct connection between the specialization and flexibility of a financial system and the development of innovative capability."

B.A. Lundval

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"While the private sector is willing to provide seed and growth funding, and offer mentoring for the creation of new companies, government is responsible for creating a favorable environment to do so. Through a competitive fiscal policy, adequate research funding and helping to fill financing gaps, the government can play an important role in developing a strong and sustainable biotechnology industry in partnership with the private sector."

René Douville,
Royal Bank of Canada

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Infrastructure: The Need

Refundable Tax Incentives

The task force welcomes the fiscal policy measures the Ontario Government has taken by cutting taxes and instituting a number of research tax incentives such as the new Ontario Business Research Institute Tax Credit to foster research and development. However, in some cases these tax incentives provide limited value for sustaining the growth of Ontario's research intensive companies and need to be revised in order to remain competitive with other jurisdictions.

Quebec offers fully refundable Scientific Research and Experimental Development tax credits accrued by biotechnology companies and has instituted 5 year tax holidays and special credits for companies locating to one of the four technology commercialization centres. New Jersey in responding to the needs of the biotechnology industry recently passed legislation that will allow biotechnology companies to sell unused research and development tax credits to other corporations.

In Ontario, Canadian-controlled **private** companies receive some **refundable** Ontario research tax credits. However, Ontario-based **publicly traded** biotechnology companies without taxable income receive **non-refundable** Ontario research tax credits. Throughout the product development cycle, companies typically operate with sizable losses and, are continually under pressure to source financial capital while simultaneously accumulating tax credits. As these tax credits accumulate, companies with promising technologies are more likely to be purchased by revenue generating companies. Many of these are multinationals which can off-set their taxable income with these tax credits. As a result Ontario can lose many of its most promising companies and products to foreign jurisdictions.

We recommend that the Ontario Innovation Tax Credit and the Ontario Super Allowance be made refundable for private and publicly traded companies. In return, these companies should be required to demonstrate that these funds have been reinvested into building and strengthening their business in Ontario.

We recommend that the province of Ontario encourage the Federal Government to implement similar policies with respect to Research and Development Tax Credits for public biotechnology companies.

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"Developing a new drug takes US$ 500 million and 15 years to develop. Only one in 5,000 drugs reaches the U.S. Food and Drug Agency as a new application, and each may take 16 months to review."

Canadian Medical Discoveries Fund, 1998

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"I believe the initiation of a program that enables the utilization of unused tax credits for specific needs such as job creation will effectively help the growth of biotechnology in Ontario."

Lorne Meikle,
Biocatalyst Yorkton Inc.

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Infrastructure: The Need

Business Climate

An overall business climate conducive to investment and job creation is key to developing a strong biotechnology industry. In addition to competitive tax and labour policies, and timely regulatory approvals (largely a federal issue), market access is essential to a company's profitability.

The Ontario Government is the largest purchasing client of pharmaceuticals in Canada covering close to 50% of prescription expenditures in Ontario. In the past, the pharmaceutical industry has experienced difficulty getting new innovative products onto the Ontario Drug Benefits formulary because of expenditure controls implemented by the Ministry of Health. This has caused due concern to the biopharmaceutical industry in Ontario since a strong domestic market is significant to the development, manufacturing and export activities of biotechnology companies. The task force welcomes the recent initiative by the government to add more than 200 new pharmaceutical products to the Ontario Drug Benefits formulary. The Task Force also acknowledges government steps in reducing red tape and in establishing the Investment Climate Committee to help develop Ontario's biotechnology industry through investment partnerships.

We recommend that products of biotechnology approved for sale in Canada receive Ontario market access in a globally competitive timeframe. In return, the industry should be required to reinvest a percentage of its net sales revenue towards the further development of biotechnology in Ontario.

We recommend that the Ontario Biotechnology Secretariat advocate at the highest levels of government for a timely regulatory approvals process for biotechnology products.

Infrastructure: The Need

Intellectual Property Protection

Intellectual property protection is a key benchmark for securing seed capital aside from its personnel, and is a biotechnology company's most important asset. It is the foundation for launching a small company down the commercialization path. Filing patents must be undertaken in a global context, in fact Ontario companies will usually file first in the United States given its market size. The cost of filing and defending patents is a serious barrier to commercialization faced by small companies.

We recommend that government in partnership with acdemia support the efforts of universities and research hospitals to protect their intellectual property.

We recommend that 50% of patent protection costs be eligible for refundable tax credits for start up biotechnology companies.

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"The basic economic resource—'the means of production,' to use the economist's term—is no longer capital, or natural resources (the economist's 'land'), nor 'labour.' *It is and will be knowledge.*"
Peter Drucker

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Biotechnology Strategy Management Plan

The Central Body for advising the provincial government would be a **Biotechnology Advisory Council.** This should be made up of no more than ten members. These members would include representatives from the financial and industrial sectors, the academic community, consumer groups and the federal government along with the three community leaders who would have non-voting status. A Flow Chart delineating the management of the biotechnology initiative is presented in Figure 1.

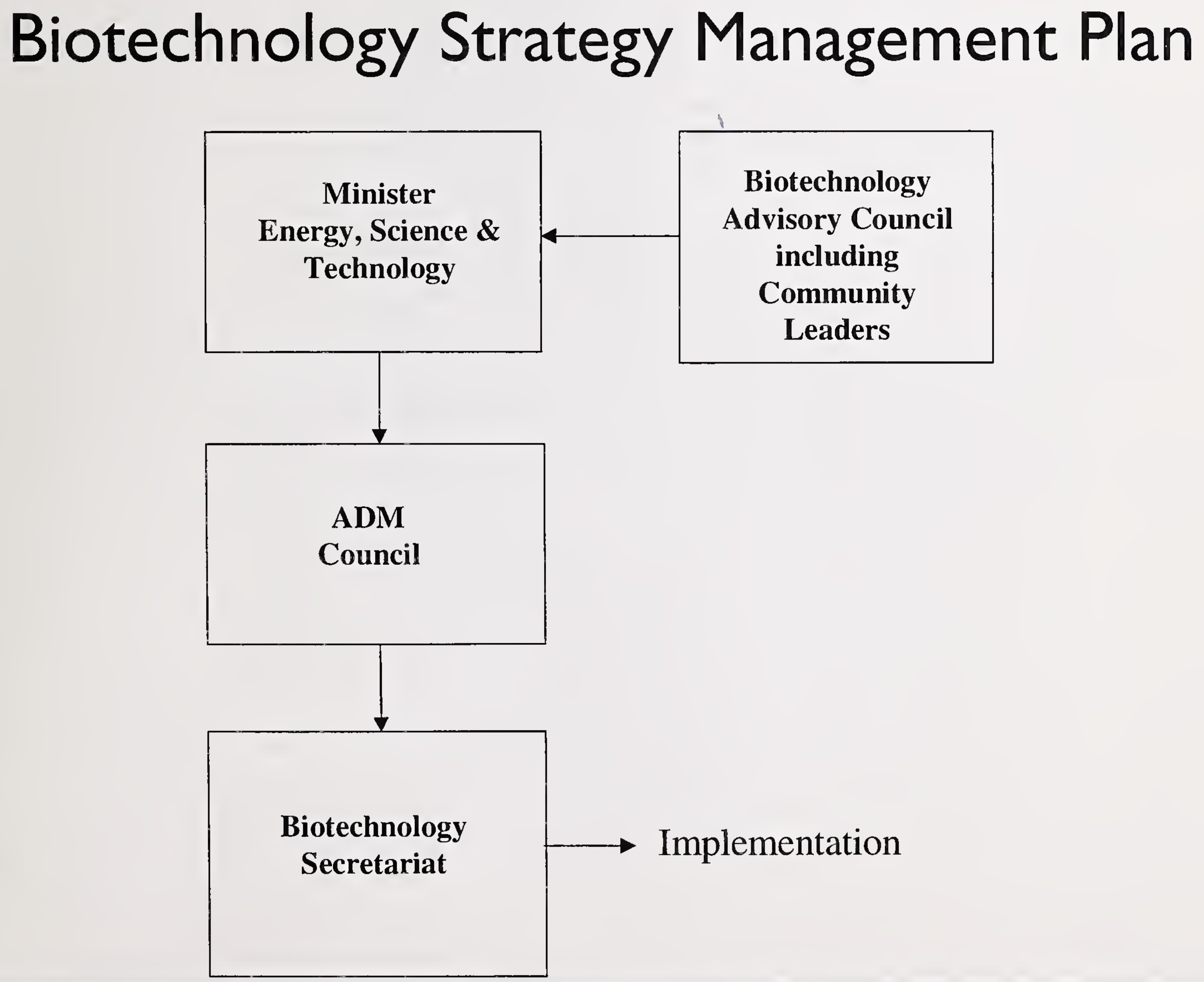
The Biotechnology Advisory Council would make recommendations to the Minister of Energy, Science & Technology. The Minister would seek guidance on implementation of the recommendations from a **Council of Assistant Deputy Ministers.** These Assistant Deputy Ministers would represent the Ministries of: Agriculture, Food & Rural Affairs; Economic Development, Trade & Tourism; Education; Environment; Finance; Health; Natural Resources; and Northern Development and Mines. This Council would be chaired by the Assistant Deputy Minister of Energy, Science and Technology.

The **Ontario Biotechnology Secretariat** within the Ministry of Energy, Science and Technology would be responsible for day-to-day coordination of initiatives, developing Terms of Reference for competitive programs and auditing existing programs funded through this biotechnology initiative.

Financial resources must be available from new budget initiatives or from existing budgets to implement recommendations from the Biotechnology Advisory Council.

This biotechnology implementation plan should be an integral component of a science policy mandate of the Ministry of Energy, Science and Technology.

Figure 1


Biotechnology Strategy Management Plan
Minister Energy, Science & Technology
Biotechnology Advisory Council including Community Leaders
ADM Council
Biotechnology Secretariat
Implementation

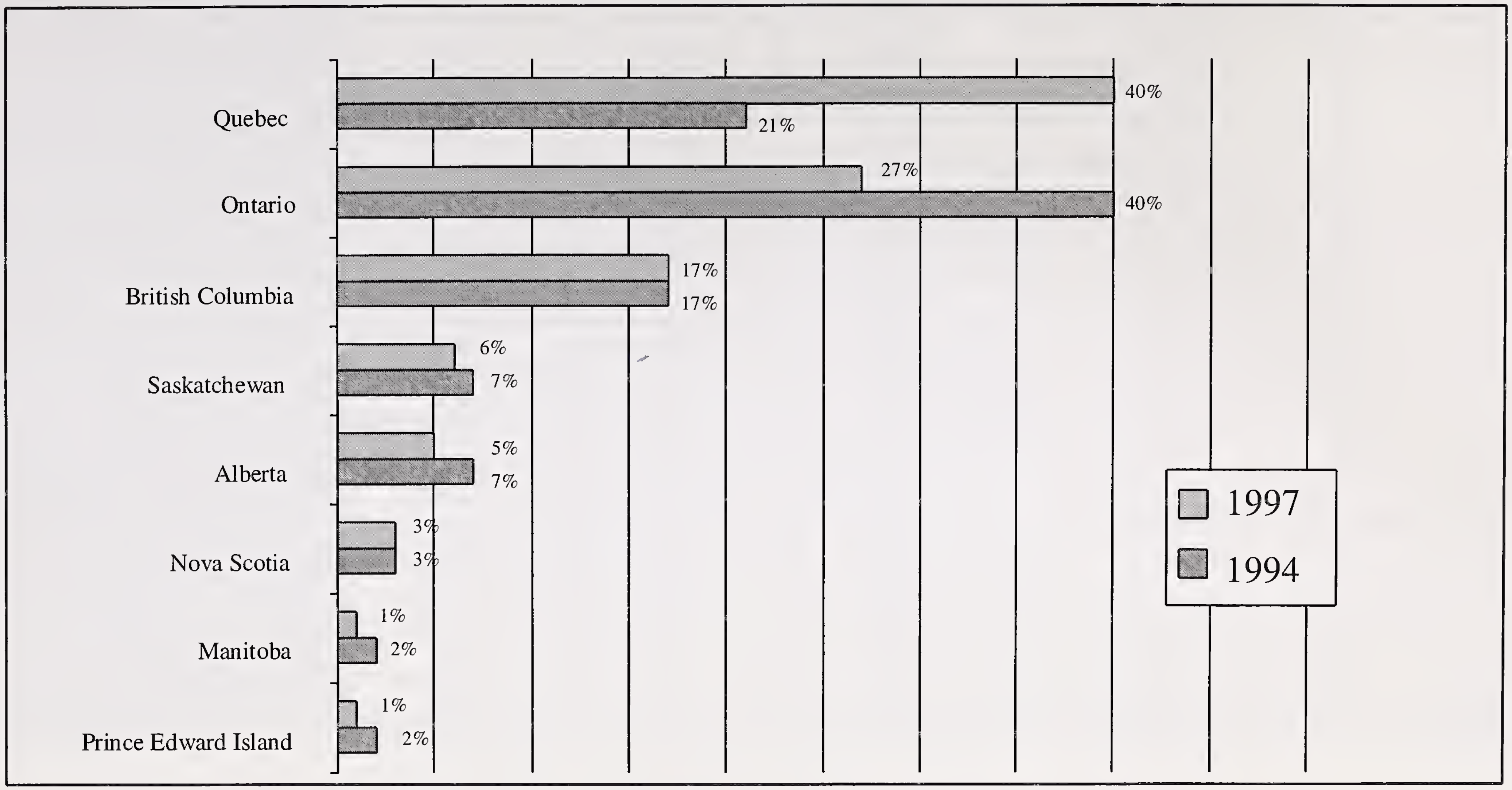
Summary

The recommendations in this document are essential and urgent if Ontario is to become a world leader in biotechnology. We recognize that there are budgetary implications for the Province of Ontario. However, we are recommending an investment in Ontario's future. The Task Force developed the recommendations with two key concepts in mind:

- Build on existing public and private sector programs and communities avoiding duplication.
- Industry and local communities need to be fiscal partners in the initiative.

We have discussed particular details of the recommendations and notional budgetary concepts within the Task Force. We would be pleased to work with your ministry and inter-ministerial staff to implement these recommendations.

Distribution of Core Biotech Companies by Province



Source: Ernst & Young

Appendix 1(B)

Major North American Biotechnology Centres by Revenue

$CDN million - Fiscal 1995

	Total Revenues	Product Sales	Net Income/ (Loss)	Cash and Short-Term Investments	Number of Public Companies
San Francisco Bay Area	$4,653	$3,266	($1,345)	$3,784	50
Los Angeles/Orange County	$4,242	$3,952	$803	$1,625	12
New England Area	$1,970	$1,262	($607)	$2,692	51
Mid-Atlantic Area	$827	$729	($182)	$467	20
San Diego Area	$797	$348	($529)	$1,037	29
New Jersey Area	$764	$633	($288)	$551	23
Florida	$414	$392	($45)	$55	7
Philadelphia/southern NJ	$336	$175	($214)	$571	9
North Carolina Area	$307	$79	($5)	$127	7
Quebec	$280	$247	($2)	$145	10
Seattle Area	$275	$215	($159)	$363	12
North York State	$193	$125	($84)	$197	13
Ontario	$146	$80	($94)	$260	25
Minnesota	$110	$93	($33)	$36	6
Texas	$92	$63	($93)	$138	11
British Columbia	$81	$62	($49)	$57	18

Source: Ernst &Young

Top North American Biotechnology Centres*

$CDN million - 1997

Centre	Top Revenues	Product Sales	Net Income (Loss)	Cash and Short-Term Investments	Number of Public Companies
San Francisco Bay Area	$5,839	$3,701	($680)	$5,324	61
Los Angeles/Orange County	$5,136	$4,776	$1,067	$1,842	14
New England Area	$2,523	$1,675	($906)	$3,175	54
San Diego Area	$1,166	$590	($552)	$1,901	33
North Carolina Area	$1,152	$1,093	($29)	$323	6
Mid-Atlantic Area	$791	$553	($148)	$819	20
New Jersey Area	$698	$590	($223)	$671	22
Philadelphia/Delaware Valley	$431	$308	($228)	$791	12
Quebec	$378	$289	$9	$449	13
Seattle Area	$336	$229	($321)	$487	13
Ontario	$301	$170	($34)	$212	23
New York State	$233	$150	($134)	$482	15
Minnesota	$104	$94	($40)	$85	5
Texas	$101	$65	($109)	$212	12
British Columbia	$67	$47	($64)	$212	20

Source: Ernst & Young

- Saskatchewan is absent from this chart as it is not host to any publicly traded biotechnology companies. However, based on Ernst & Young's Canadian Biotech '97, Saskatchewan is an important biotechnology centre with many private companies and significant fundraising activity.

Appendix 2(A)

The Methodology Used in Developing the Biotechnology Task Force Report

In September 1998, Jim Wilson, Minister of Energy, Science and Technology appointed a 16-member Task Force, chaired by Graham Strachan, to report back to him by December 31st, 1998 with a biotechnology strategy for Ontario.

Given the time frame of this mandate, the Task Force referred to numerous public documents in the following list that have recently been issued recommending strategies for biotechnology at the federal and provincial levels. The Task Force also relied on the extensive background of its members which represent the respective industry sectors applicable to biotechnology and academia from around the province.

The Task Force held four meetings to complete their task. At the outset of these meetings the Task Force agreed that the report should be practical, implementable and budget modest. The focus of the report should be on investing in enabling platforms from which a strong biotechnology industry can flourish. These platforms ascribe to the three areas identified by the Ontario Jobs and Investment Board as key to economic growth namely, people, a culture of innovation and infrastructure.

With key elements in place, the Task Force held nine consultations around the province to seek the input and endorsement of the larger biotechnology community. The ministry also set up a website, issued a press release and provided an email address to ensure effective communication. The Task Force received valuable comments from stakeholders and made every attempt to consider these for inclusion in the final document.

The Task Force report follows closely on the heels of the Canadian Biotechnology Strategy. A meeting with federal counterparts was held to examine areas of future cooperation and effective federal/ provincial coordination.

A biotechnology secretariat was set-up in the ministry's Science and Technology Division to support the Task Force in the development of the report. The secretariat will continue to function as the one-window access to government on biotechnology and to provide interministerial coordination of biotechnology.

Appendix 2(B)

Biotechnology Reports and Studies

1998	Canadian Biotechnology Strategy _ *Health, Agriculture* _ *Forestry, R&D, Mining, Environment*
1998	National Biotechnology Advisory Committee, 6th Report - 46 Recommendations
1997	Bio Industries - Sector Competitiveness
1997	Canadian Biotech '97 - Coming of Age
1996	Canadian Human Resources Study in Biotechnology
1994	Enabling Biotechnology: A Strategic Plan for Ontario

- Biotechnology Sector Strategy Development: Working Group Reports
- Biotechnology: Social & Ethical Issues
- Ontario's Agri-Food Biotechnology Needs Assessment Report (1998)
- Advanced Agri-Food Technologies Strategy (1998)
- Federal Sector Consultation Documents
- Biotechnology Use By Canadian Industry (1996)
- Bioentrepreneurship

Appendix 3

Ontario Biotechnology Task Force Members and Supporting Structure

Mr. Graham Strachan	President & CEO Allelix Biopharmaceuticals Inc.

Members

Dr. Alan Bernstein	Director Samuel Lunenfeld Research Institute, Mount Sinai Hospital
Mr. Borys Chabursky	Principal Optium Health Solutions
Mr. René Douville	Vice President Life Sciences & Health Care, Royal Bank of Canada Life Science & Agri-Sciences, Royal Bank Growth Corporation
Mr. Randal Goodfellow	President Goodfellow Agricola Consultants
Ms. Ann Humphreys	Vice President Biotech and New Product Development Janssen-Ortho Inc.
Ms. Ruth Jackson	Co-Chair, Food Committee Consumer's Association of Canada
Mr. Ken Lawless	Executive Director Ottawa Life Sciences Council
Mr. Mark Lievonen	Acting President Pasteur Mérieux Connaught Canada
Dr. Murray McLaughlin	President Ontario Agri-Food Technologies
Mr. Lorne T. Meikle	President & CEO Biocatalyst Yorkton Inc.
Mr. Brian Prendergast	President Monsanto Canada Inc.
Dr. David Turpin	Vice-Principal (Academic) Queen's University

Appendix 3

Ontario Biotechnology Task Force Members and Supporting Structure

Members (cont'd.)

Dr. J.R. (Jack) Wearing	President Toronto Biotechnology Initiative Wearing Development Inc.
Mr. Ron Yamada	Senior Vice President Information Strategies & Corporate Affairs MDS Inc.
Ms. Stephanie Yanchinski	Consultant Biotechnology Communications

Biotechnology Secretariat

Dr. Gordon Surgeoner	Director
Ms. Eleonore Rupprecht	Senior Policy Advisor
Mr. Peter Molnar	Senior Policy Advisor
Ms. Yolanda Ho	Administrative Assistant

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